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A2 MILK: BIOLOGICAL CHARACTERISTICS, HEALTH IMPLICATIONS, TECHNOLOGICAL PROPERTIES AND MARKET PERSPECTIVES

MLEKO A2: WŁAŚCIWOŚCI BIOLOGICZNE, IMPLIKACJE ZDROWOTNE, ZNACZENIE TECHNOLOGICZNE I PERSPEKTYWY RYNKOWE

***Summary**: Milk, containing exclusively A2 variant of ß-casein is a growing segment of the market of dairy products, the popularity of which results from the data suggesting the better food tolerance and potential health profits as compared to the traditional A1 variant-containing milk. In the elaboration, the review of the current knowledge on diversification of ß-casein, biochemical differences leading to different profiles of bioactive peptides, especially of ß-casomorphine and their physiological consequences, have been presented. There were discussed the results of clinical, experimental and epidemiological tests concerning impact of A1 and A2 milk on functioning of gastrointestinal, cardiovascular, and immunological systems, and on central nervous system. There was also presented the technological importance of ß-casein variants and the current market and legal trends connected with the production of A2 milk. The collected data indicate that A2 milk may be characterized by more favourable profile of affecting the human organism; however, a part of the observations requires to be confirmed in long-time, well controlled clinical studies.*

***Keywords**: A1 and A2 ß-casein ; BCM-7; A2 milk; technological properties of milk*

Streszczenie: Mleko zawierające wyłącznie wariant β-kazeiny A2 stanowi rosnący segment rynku produktów mlecznych, którego popularność wynika z danych sugerujących lepszą tolerancję pokarmową oraz potencjalne korzyści zdrowotne w porównaniu z mlekiem konwencjonalnym zawierającym wariant A1. W niniejszym opracowaniu przedstawiono przegląd aktualnej wiedzy dotyczącej zróżnicowania β-kazeiny, biochemicznych różnic prowadzących do odmiennych profili peptydów bioaktywnych – zwłaszcza β-kazomorfiny-7 – oraz ich konsekwencji fizjologicznych. Omówiono wyniki badań klinicznych, eksperymentalnych i epidemiologicznych dotyczących wpływu mleka A1 i A2 na funkcjonowanie układu pokarmowego, układu sercowo-naczyniowego, odpornościowego oraz ośrodkowego układu nerwowego. Przedstawiono również znaczenie technologiczne wariantów β-kazeiny oraz aktualne trendy rynkowe i regulacyjne związane z produkcją mleka A2. Zebrane dane wskazują, że mleko A2 może charakteryzować się korzystniejszym profilem oddziaływania na organizm człowieka, jednak część obserwacji wymaga potwierdzenia w długoterminowych, dobrze kontrolowanych badaniach klinicznych.

Słowa kluczowe: β-kazeina A1 i A2; BCM-7; mleko A2; właściwości technologiczne mleka

Introduction and genetic background of ß-casein

Cow milk has been for centuries, a significant component of human diet, supplying the fully-valuable proteins, fats, vitamins and mineral constituents. In spite of the high nutritive value, a considerable part of population suffers from gastric discomfort after its consumption. The traditional reason for the mentioned symptoms was perceived, first of all, in lactose intolerance; however, the growing number of the studies suggests that the comparable symptoms may be connected with another milk component – A1 variant of ß-casein [21, 33].

Caseins account for ca. 80% of the total quantity of milk proteins and include four main sub-types: αS1, αS2, ß and κ. From among them, ß-casein, representing 30–35% of total milk proteins, is characterized by the greatest nutritional importance and the highest genetic variation [2]. Until now, numerous variants of ß-casein have been described but A1 and A2 forms are most significant in the context of physiological effect [35].

A2 variant is considered as the primary one, occurring in wild cattle ancestors before appearance of a point mutation in CSN2 gene where proline in position 67 was replaced by histidine, leading to generation of A1 variant [32, 49]. Contemporarily, A1 variant dominates in high productive breeds such as Holstein-Friesian or Ayrshire whereas the breeds with lower milk productivity such as, *inter alia*, Guernsey or Jersey preserved a higher participation of A2 allele [48].

The frequency of occurrence of ß-casein alleles differs significantly between the world populations. In Europe and the

North America, A1 allele is dominating (ca. 60%) while in the cattle population of Asian and African origin, A2 allele is more often met [30, 35].

The selection oriented to improvement of utility traits – especially of milk performance – affected the distribution of ß-casein variants, being often favourable for popularization of A1 allele at the cost of primary A2 allele [1]. At the same time, the studies indicate that other milk protein fractions reveal polymorphisms having a technological and nutritional meaning, *inter alia*, κ-casein, α-lactalbumin and ß-lactoglobulin what additionally complicates evaluation of technological and health value of milk [28, 29].

Growing popularity of milk is driven by the scientific data as well as by market trends. As compared to the period of 2019-2023, the meaningful increase of value as well as incomes from A2 milk production, i.e. from ca. 2.5–3 billion USD to ca. 4 billion USD in 2024 was recorded [40, 44].

Generally available results of the studies suggest that variants of ß-casein may differ in potential impact on functioning of alimentary tract, immunological response and health state of cardio-vascular system [21, 23]. The mentioned differentiation has become a stimulus for intensive development of clinical and experimental studies, the results of which are the basis for further analyses.

Biochemical differences between A1 and A2 ß-casein

A1 ß-casein and A2 ß-casein differ in a single aminoacid substitution in position 67 of the polypeptide chain: in A2 variant, is it proline whereas in A1 variant – histidine [32, 49]. The mentioned change although minimal at the level of sequence, has a fundamental meaning for structural protein properties and its susceptibility to proteolysis in the alimentary tract. The presence of proline stabilizes local conformation of the chain, creating the structure more difficult for breaking by the digestive enzymes, especially by pepsin, pancreatic elastase and chymotrypsin [35]. Histidine present in A1 does not ensure such stabilization, in consequence of which the same site becomes easily available for proteases what leads to different run of hydrolysis.

The most important biochemical consequence of the mentioned differentiating cleavage is a release of ß-casomorphin-7 (BCM-7), opioid-like 7-amino acid peptide, generated during digestion of A1 variant [22]. It was demonstrated in many studies that BCM-7 revealed a capability of binding with the μ-opioid receptors in the gastrointestinal tract and nervous and immunological systems [11, 41]. *In vitro* studies confirm that A1 beta-casein-containing milk releases 2–3 times more BCM-7 than A2 variant-containing milk [7, 37]. The mentioned differences are especially visible in early stages of gastric digestion where pepsin initiates a cleavage leading to formation of opioid precursors.

Digestive process of ß-casein occurs in stages and includes a sequential protein hydrolysis by gastric and pancreatic enzymes (Fig. 1). The stage initiated in the stomach where pepsin causes the first cleavages, leading to precursor peptides' generation, has a key meaning for differences between A1 and A2 variants. A1 beta-casein is more susceptible to cleavage what enables a release of BCM-7 [32, 49]. The discussed peptide may penetrate the bloodstream after the passage through enterocytes, especially in the conditions of the elevated permeability of gut barrier [11].

Opioid peptides, including BCM-7, reveal a wide spectrum of biological activity: they affect the intestinal mobility, tension of smooth muscles, secretion and modulation of inflammatory processes via effect on μ-opioid receptors [21, 41]. In animal models, consumption of A1 ß-casein led to increase of mucus

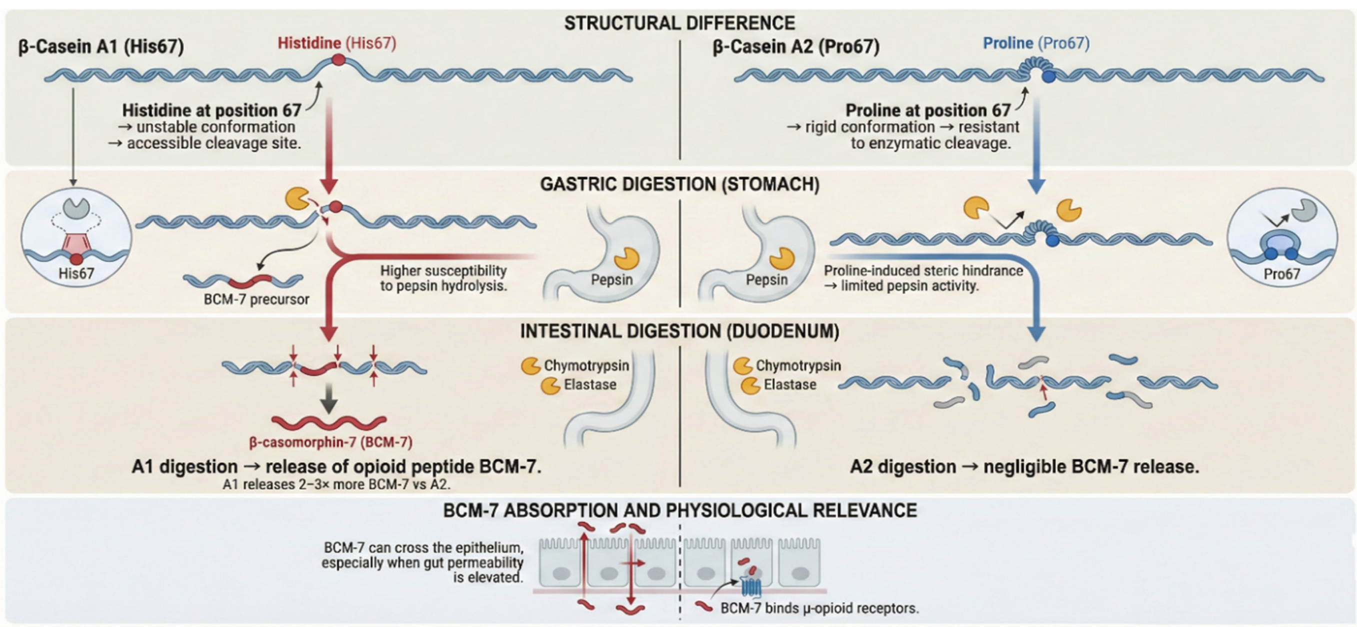

Fig. 1. Run of the process of absorption of the products of A1 and A2 beta-casein digestion (own elaboration)

secretion in the alimentary tract, production of pro-inflammatory cytokines (e.g. IL-4 and IL-13) and inflammation symptoms which could be inhibited by naloxone, antagonist of opioid receptors (4). It shows that structural differences between A1 and A2 variants are directly translated into different profile of bioactive peptides and their physiological effects.

The discussed differences gain the additional meaning in the context of the observed different clinical responses to A1 and A2 milk consumption [18, 19, 21]. In the studies, biochemical consequences, especially liberation of BCM-7, are the explanation of differences in food tolerance and inflammation responses of the consumers [33].

Summing up, although A1 and A2 ß-caseins differ only in a single amino acid substitution, the discussed change determines the completely different run of hydrolysis, the level of generation of active opioid peptides and their impact on organism. The mentioned biochemical differences constitute the basis for further physiological and clinical analyses.

Gastrointestinal system: clinical data, microbiota and metabolism

During recent years, the results of the studies, as contained in the available literature have supplied evidence supporting the hypothesis on difference in tolerance and physiology of the gastrointestinal tract, being dependent on the profile of ß-casein (Fig. 2). The conducted studies suggest that the milk, containing exclusively A2 variant, causes less symptoms of intestinal discomfort and reveals more favourable effects on the selected inflammation markers and microbiota as compared to the traditional milk, containing A1/A2 [14, 20, 21].

It was demonstrated that A2/A2 milk consumption did not increase the symptoms of subjective digestive discomfort and was connected with the shorter transit time of food through digestive system as compared to A1/A2 milk what was described in the adult representatives of Chinese population [18]. The similar results concerning the abbreviated transit time and lower frequency of loose faeces was also observed in animal models [14, 16] where A2 milk increased the amount of short-chain fatty acids (SCFA) and improved morphology of intestine villi in older mice.

The newest clinical tests have supplied the additional evidences concerning the reduction of objective inflammation markets after consumption of A2 milk. The studies of Choi et al. (2024) showed that consumption of A2 milk mitigated significantly abdominal pains and faecal urgency and was connected with the lower gain of faecal calprotectin – marker of intestine inflammation – as compared to A1/A2 milk [9]. The mentioned result coincides with the observations of Ramakrishnan et al. (2024) who tested the persons with the lactose intolerance and revealed lowering of the symptoms (nausea, bloats, feeling of faecal urgency) after 2-week consumption of A2 milk as compared to A1 milk; at the same time, the authors have not observed a significant enzymatic improvement in digestion of lactose what suggests that mechanism of A2 advantages did not consist in recovery of lactase activity but in other physiological effects [34].

Microbiological tests supply coherent results: consumption of A2 milk was connected with the changes, favourable for the composition of intestinal microbiota, including the increase of relative abundance of the beneficial bacterial strains, such as *Bifidobacterium* and *Blautia* [16, 43]. The studies of Kaplan et al. (2022) in the context of sport nutrition have also indicated that A2 milk is better tolerated and causes less gastric discomforts in active persons what has a practical meaning for recovery of metabolic balance after physical effort [23].

The literature reviews confirm that A2 milk generates considerably lower quantities of ß-casomorphin-7 in the

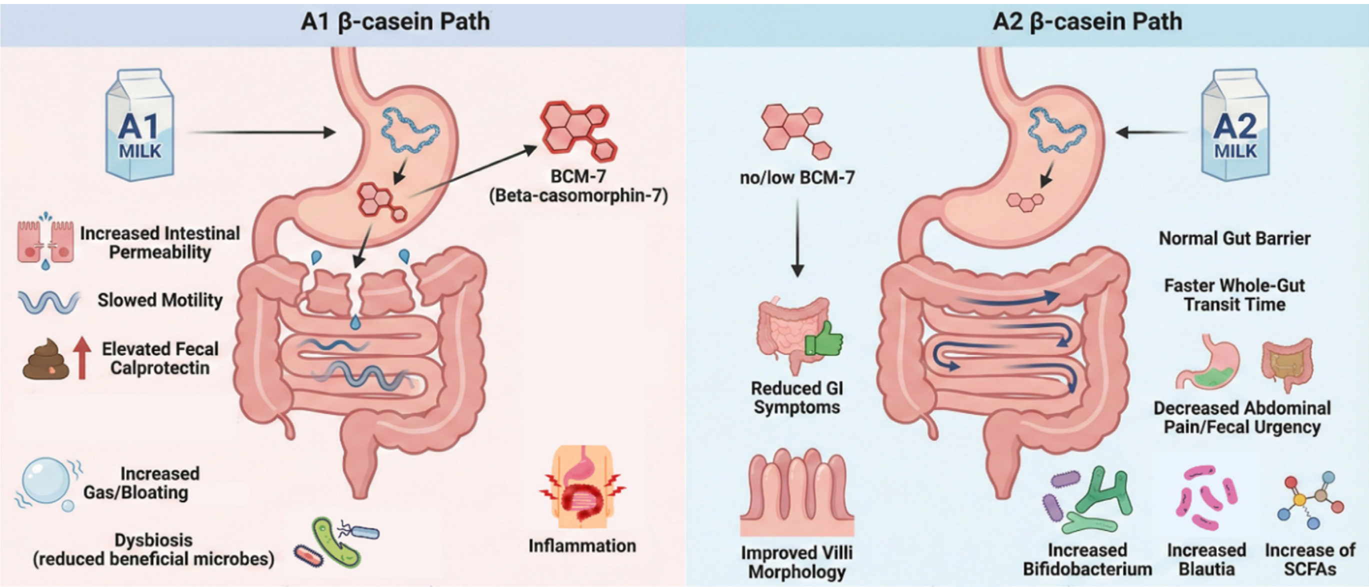

Fig. 2. Effect of A2 milk consumption on functioning of gastrointestinal tract (own elaboration)

conditions of *in vitro* and *in vivo* digestion what probably determines lower activation of μ-opioid receptors in gut and slowed motility and secretion [14, 20]. Jeong et al. (2024) mentioned additionally that A2 is often preferred by the persons with lactose intolerance due to better digestibility and lower discomfort; clinical observations suggest reduction of the symptoms in children after replacement of traditional milk by A2 milk [20].

Simultaneously, a systematic review by Brooke-Taylor et al. (2017) and meta-analyses indicate the heterogenicity of the studies; not all tests reveal the meaningful differences in all measured parameters (e.g. in frequency of defecations or the total image of digestion in certain subgroups) what results from the differences in the project of the studies, their duration time and population characteristics [6]. Jianqin et al. (2016) have demonstrated that A2 milk consumption did not deteriorate the digestion parameters in relation to the initial stage and in the case of certain examined persons, the improvement of the health state of small intestine and stomach was observed.

The studies on animal models supply the additional guidelines: A2 ß-casein is favourable for higher SCFA concentrations, improvement of histological structure of guts and favourable microbiota, supporting intestinal homeostasis [14, 16]. In clinical practice, the conducted work reveals a decrease in calprotectin level and subjective symptoms [9, 43].

Potential health-related consequences of A1 and A2 milk consumption

Biochemical and digestive differences between A1 and A2 ß-casein constitute the basis for the hypothesis that the mentioned variants may cause the different physiological consequences, exceeding the alimentary system. In literature, the attention is paid to three main areas: cardiovascular system, nervous system and immunological system. Although a part of the results remains the subject of discussion, the collected data indicate that bioactive peptides, originating in A1 variant, may have the potential pro-inflammatory effect, modulating the neuronal functions and affecting the metabolic risk.

Hypothesis on the effect of ß-casein variants on the risk of circulatory system diseases is first of all based upon observation that bioactive BCM-7 peptide reveals pro-oxidative and immunomodulatory properties and may indirectly affect the mechanisms of occurrence of atherosclerosis and haemodynamic disorders [5, 42, 46]. The experimental tests on animal models suggest that diet rich in A1 is connected with the unfavourable changes in blood vessels – especially the accelerated formation of atherosclerosis sites and occurrence of unfavourable lipid profile – whereas A2-containing diet reveals the neutral or protective effect [46, 47]. Fig. 3 shows the effect of A1 and A2 ß-casein on cardiovascular system.

The results of clinical tests are not univocal. Some analyses indicate the favourable effect of A2 milk on markers of cardiometabolic risk: Almuraee (2019) demonstrated a decline of CRP (C-reactive protein) after A2 milk intake and improvement of certain metabolic parameters while the reports and systematic review stress a lack of univocal evidence concerning a significant difference in classic lipoprotein markers and arterial blood pressure in the short-time studies [3, 12]. Also, the controlled tests do not often reveal any significant differences in arterial blood pressure or total cholesterol level between A1 and A2 milk consumption what indicates the translatory limitations of the results of the tests on animal models [8, 25].

Jeong et al. (2024) cite the epidemiological reports connecting A1 and heart diseases and indicate the potential pro-inflammatory mechanism of A1 variant in the context of circulatory system [20]. However, the authors of critical reviews [12, 47] emphasize that the observation data have the limitations

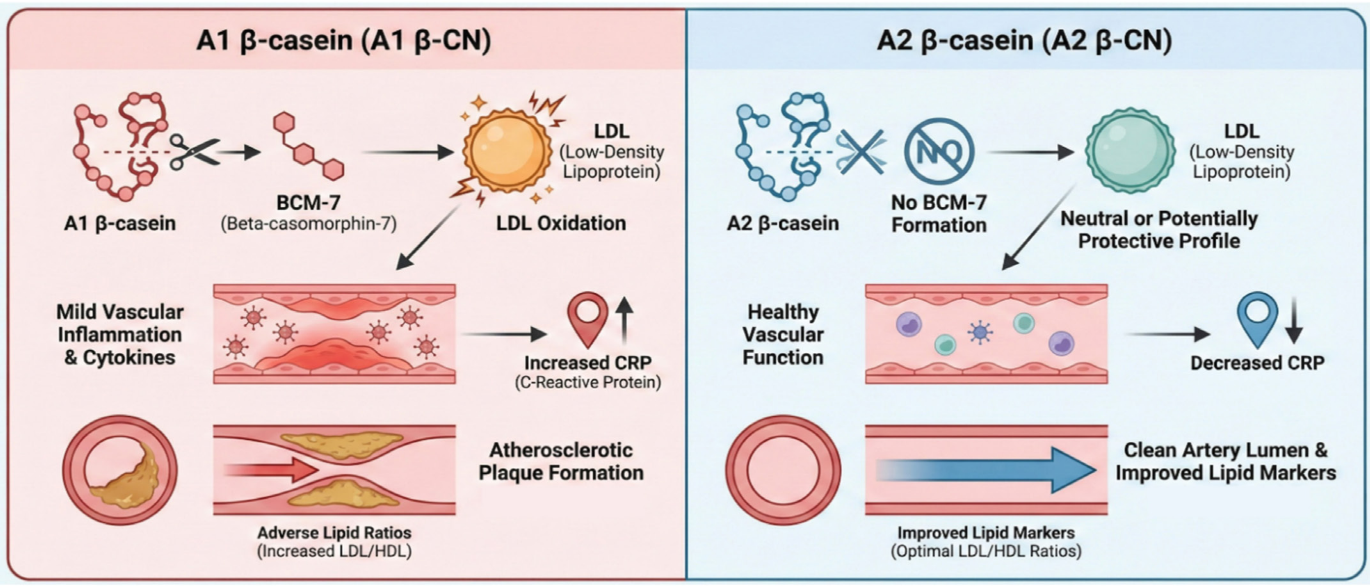

Fig. 3. Impact of A1 and A2 ß-casein on cardiovascular system

and without randomized, long-term intervention tests it is not possible to draw the definitive conclusions in respect of the exact reasons.

The experimental studies suggest that BCM-7 may act as pro-oxidative and pro-inflammatory factor what , theoretically, is favourable for formation of atherosclerosis plaque [42, 26]. In the studies on the rabbits, the smaller range of atherosclerotic changes after A2-containing diet as compared to A1 and more favourable ratio LDL/HDL, were found [46]. Such pre-clinical data give the biological basis for hypothesis on atherogenic effect of A1, especially in combination with cholesterol-abundant diet [5].

At the same time, the literature contains critical opinions and the results negating harmfulness of A1 variant. Truswell (2005) indicates the lack of convincing evidence, which would univocally confirm the A1 effect on cardiovascular final clinical points [47]; similarly, Chin-Dusting et al. (2006) have not observed A1 advantage in deterioration of cardiometabolic parameters in the intervention test and the total reduction of cholesterol after supplementation with the both discussed variants suggests that the dietetic effect may be multi-factorial [8].

The literature reviews [12, 24] stress that the so-far conducted tests are short-lasting, they cover small number of participants and seldom control the long-term risk factors. In the light of the above facts, the authors call for precaution: the available experimental and epidemiological evidence generates the hypothesis on the possible relation of A1 and the processes, favourable for cardiovascular diseases but the results of clinical human tests are not univocal and insufficient to formulate the univocal health recommendations [20, 47].

More and more data indicate that the differences between A1 and A2 ß-casein variants may include not only gastrointestinal tract and circulation system but also functioning of the central nervous system. BCM-7 may affect the µ-opioid receptors, present in the human brain structures, modulating the neuro-inflammatory response, neurotransmission and behavioural functions.

Semwall et all. (2022) showed that the consumption of traditional milk (A1/A2) by small children brought about to deterioration of cognitive functions as compared to A2 milk; A2 milk improved significantly the cognitive behaviour and general cognitive performance what, in the opinion of the authors, was connected with the lack of the release of neuroactive peptides (38).The researchers suggest that just the peptides, generated from A1 ß-casein may cause the neuro-inflammatory disorders and deterioration of the brain functioning, especially in the case of children. In effect, the authors recommend the replacement of the traditional milk by the A2 products for the developing children.

The mechanism of neuroactivity of BCM-7 has been widely described in the review of Cieślińska et al. (2022) where it was demonstrated that A1 variant of ß-casein, in the contrary to A2, releases consequently BCM-7 during digestion. The mentioned peptide, when acting via opioid receptors, may constitute a factor of a risk of neurological disorders, including schizophrenia [10]. A similar conclusion was presented by Bell et al. (2006), indicating that A2 milk intake may mitigate the neurobehavioral symptoms, connected with the mentioned disorders, inter alia, owing to avoidance of the excessive activation of opioid receptors in central nervous system (Polish: OUN) [5].

In their studies, Zhang et al. (2025) revealed that the consumption of A1-free milk by the adult persons with mild cognitive disorders led to better results in all cognitive tests as compared to the traditional milk. The authors notice that A1 variant might be favourable for generation of inflammatory states in the nervous system, probably due to the elevated permeability (induced by inflammatory cytokines) of the blood-brain barrier. Consumption of A2 milk was connected with the improvement of life quality, mood and general cognitive function of the examined persons [50].

Also, the data from the animal studies confirm that beta-casein variants may modulate functioning of nervous system. Osman et al. (2021) demonstrated that A2 milk (2021) demonstrated that A2 milk intake after weaning period did not lead to the increased depression or the changes in metabolic profile in the brain of rats [31]. On the other hand, in the case of animals, fed A1 milk, the changes in expression of µ-opioid receptors and brain metabolites were found; it suggests the influence of intestine-brain axis on the depression behaviours. The authors conclude that A1 variant may modulate the mood and behaviour.

From the neurophysiological viewpoint, the data concerning antioxidative potential of A2 milk are also meaningful. Robinson et al. (2025) demonstrated that the consumption of A1-free milk leads to greater increase of glutathione concentrations what may support neuroprotection and reduce oxidative stress within the central nervous system [36].

The successive evidences come from clinical tests concerning cognitive functions. Jianqin et al. (2015) demonstrated that the milk, containing only A2 ß-casein did not deteriorate the speed or precision of information processing whereas A1 milk consumption was connected with the unfavourable gastro-intestinal effects as well as with the deterioration of neurodevelopment parameters [21]. On the other hand, Starck et al. (2025) demonstrated that the change into A1-free milk improved mood, reduced fear, depression and stress and increased the subjective cognitive efficiency, especially in the case of women [45].

In the studies, there are also reports concerning A1 and A2 impact on immunological responses (Fig. 4). BCM-7 may modulate the inherent as well as acquired trait. The experimental studies provide the coherent data, confirming that A2 ß-casein may enhance the immunological response without inducing the undesired inflammatory reaction. Li et al. (2024) demonstrated that A2 milk consumption increased meaningfully the levels of IgG and IgA immunoglobulins in immunosuppressive mice, stimulated proliferation of spleen lymphocytes and regulated disorders of intestinal microbiota via increase of the participation of beneficial bacteria and reduction of pathogenic microorganisms [26].

Similar observations were reported by Liu et al. (2022) who stated that consumption of milk, containing only A2

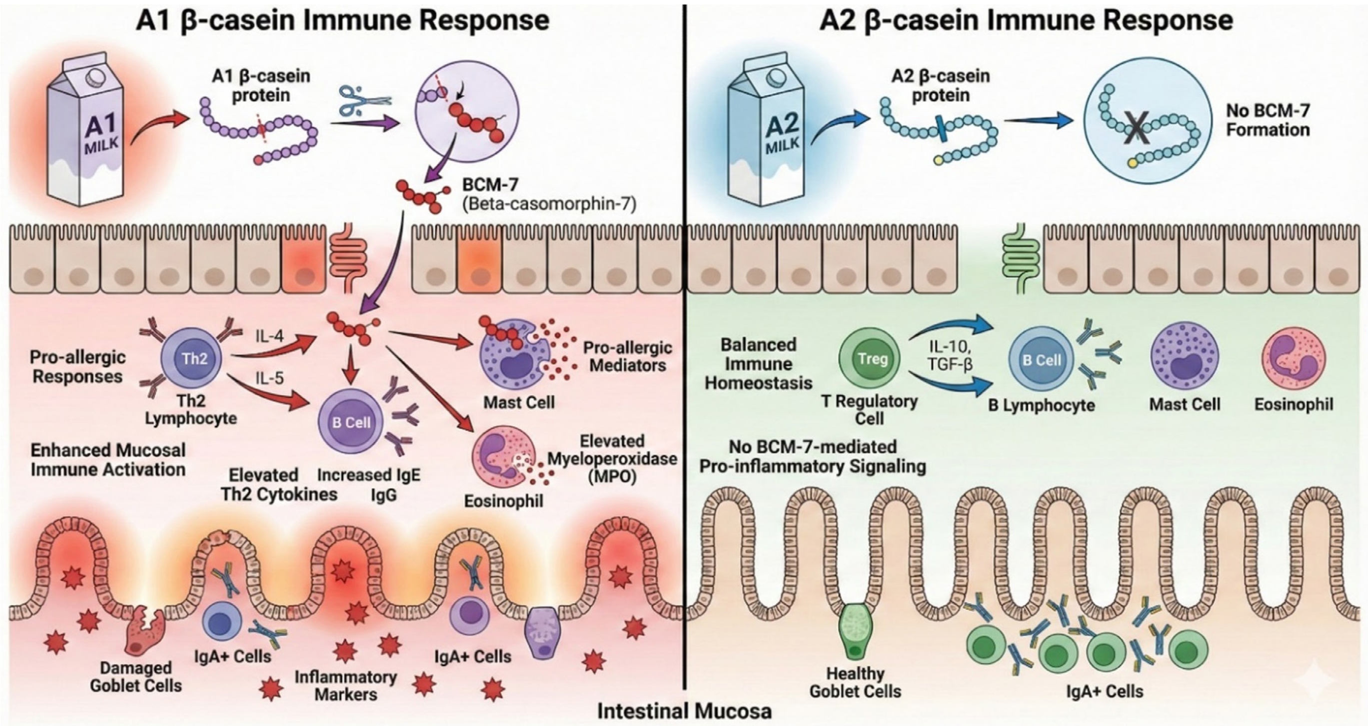

Fig. 4. The response of immune system to consumption of A1 and A2 milk

ß-casein increased the levels of IgG and IgE in blood serum and modulated the systemic response via increase of the circulating immune factors, with the simultaneous lack of relevant effect on inflammatory markers [27].

The studies of Haq et al. (2014) supplied the additional evidence that the consumption of A2A2 milk by the mice generated significantly weaker response Th2 as compared to A1 variant what suggests its more favourable immune-compatibility [17]. The mentioned data are coherent with the newer results of Yadav et al. (2020) who demonstrated that A1 led to intensification of Th2 cytokines in the respiratory system (IL-4, IL-5) whereas A2 did not cause any comparable pro-allergic effect or any increase of bronchial hyperreactivity [49].

BCM-7 may affect the immunological system via influence on μ-opioid receptors present on the surface of immune cells. The results of the studies of González-Rodrigues et al. (2025) confirm that BCM-7 may modulate activity of lymphocytes, promote inflammatory response and, potentially, contribute to allergic responses [15]. The authors stressed also that in clinical tests A2 milk resulted in lower levels of inflammation markers and more favourable immunological parameters as compared to A1 milk.

The data of Jeong et al. (2024) indicate additionally that A1 milk consumption increased activity of myeloperoxidase and could lead to intensification of inflammatory processes in sensitive persons, what did not occur in the case of A2 milk [20]. The authors emphasized also that BCM-7 may affect secretion of cytokines by human mononuclear cells of peripheral blood what is a mediating mechanism of inflammatory response, induced by A1 variant.

The results of Sheng et al. (2019) from the randomized test in population of children revealed that the consumption of the traditional milk led to the increase in concentration of IL-4, IgG, IgE and also, to the increased level of BCM-7 and lower glutathione concentration. In the case of A2 milk intake, such effects were not recorded what emphasizes the potentially favourable impact of A2 on oxidative and immune homeostasis [39].

Technological properties and suitability of A2 milk in processing

The structural differences between A1 and A2 ß-casein variants have the relevant technological implications for milk processing. The mentioned differences affect the hydrophobicity of molecules and, in consequence – on the method of organization of casein micelles and their interactions with the remaining protein fractions, and first of all, with κ-casein.

The studies concerning the polymorphism of milk proteins confirm that ß-, κ- and α-casein variants determine significantly the technological properties of a raw milk, irrespectively of the profile of A1/A2 ß-casein itself [13, 28, 29]. Variant of B type of κ-casein and variant of B type of ß-casein are favourable for more firm curd, shorter coagulation time and higher cheesemaking performance while the presence of A2 allele is connected with the less firm curd, slower coagulation and different profile of micellar hydration.

The mentioned above differences are reflected in the parameters relevant for production of cheeses, fermented dairy products and UHT milk. The reports indicate that A2 ß-casein may be characterized by more favourable heat stability what has meaning especially in sterilization and preservation processes [2]. Simultaneously, Malacarne et al. (2023) and Mariani et al. (2022) emphasize that each change in ratios of protein variants, including the differences A1/A2, may modify the properties of rennet coagulation, elasticity and firmness of curd, thermostability of milk, its clarity and, also, parameters of foam and emulsion [28, 29].

In the studies of Dinç et al. (2013) it was additionally revealed that the traditional breeds of the Anatolian (Turkish) cattle are characterized by a high diversity of polymorphisms within the milk proteins what is reflected in a high quality of regional products [13]. It is important in the context of A2 milk production as the intensive selection for ß-casein alleles should not lead to elimination of favourable variants of other proteins, especially those technologically relevant.

The available elaborations suggest also that A2 milk may possess somewhat different sensory traits, including the changed texture or foaming ability what results from its unique physical-chemical parameters [2, 44]. The mentioned data are, however, limited and require further studies.

Market and legislative aspects of A2 milk

During recent years, milk containing exclusively A2 ß-casein has become a significant segment of global market of dairy products. Its development results from the combination of scientific data concerning better tolerance in a part of the consumers, marketing activities and the growing interest in functional food. As it was described by Ariton Adina-Mirela et al. (2023) and Staffolani et al. (2023), the key market stimulus came from foundation of A2 Corporation company (now: The a2Milk Company™) in 2000; the Company implemented the first system of production of milk, derived exclusively from the cows with genotype A2/A2 [2, 44]. The mentioned strategy initiated a dynamic expansion of A2 products in Australia, New Zealand, China, the USA and Europe.

In the market analyses, Shukla et al. (2024) indicate that the global value of A2 milk market exceeded 3 billion USD in 2024 and the annual rate of growth is equal to 10-12% [40]. The demand is connected with the growing number of the consumers seeking for natural products, with a declared higher food tolerance, especially in the context of intestinal symptoms.

The legal regulations concerning A2 milk are, however, differentiated. In Australia and New Zealand, marking "A2Milk™" is a registered trademark of the company what is connected with the duty of certifications and audits. In the European Union, there is a lack of consolidated legal act, defining a category of A2 milk; there are admitted declarations based upon reliable documentation of genotyping, in compliance with the principles of trade reliability [44]. In the Northern America, the discussed products may be marked as A2 in accordance with the general rules concerning the trueness of declaration.

In the breeding context, the attention is also paid to the fact that the intensive selection for A2/A2 genotype should be a sustainable strategy, preserving the genetic variation of the population. Mukesh et al. (2022) emphasize the necessity of the simultaneous consideration of the utility and health traits and polymorphisms of other milk proteins, including technologically relevant variants such as κ-casein B and ß-casein B [13, 30]. The sustainable approach is crucial in the light of global popularization of A2 milk and growing importance of the discussed sector of the market. In many countries, the herds are routinely genotyped what facilitates constructing the population of fully homozygotic A2/A2 and production of certified raw milk [44].

Summing up

A2 milk, as containing exclusively A2 variant of ß-casein, differs from the traditional milk in respect of biochemical properties as well as potential impact on human organism. The differences in amino acid sequence lead to different profile of peptides, generated during digestion, including the limited production of ß-casomorphin-7 what may explain more favourable effect on intestinal motility, inflammation response and food tolerance. The results of clinical and preclinical tests indicate that A2 milk may be favourable for better digestive comfort, modulate favourably the microbiota, reveal milder pro-inflammatory effect and potentially support the cognitive functions. Simultaneously, the data concerning the cardiovascular and immune system remain partially non-univocal and require further verification. A2 milk becomes to be important for dairy processing and is a dynamically developing segment of the functional food market. The collected evidences emphasize the need of further, long-term studies of its impact on human health and on the optimization of production in the technological and breeding context.

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